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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/540,732	07/25/2005	Poopathy Kathirgamanathan	LUC-015	9084
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David Silverstein Andover IP Law Suite 300 44 Park Street Andover, MA 01810			EXAMINER YAMNITZKY, MARIE ROSE	
			ART UNIT 1794	PAPER NUMBER
			MAIL DATE 02/04/2010	DELIVERY MODE PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/540,732

Applicant(s)

KATHIRGAMANATHAN ET AL.

Examiner

Marie R. Yamnitzky

Art Unit

1794

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 09 November 2009.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 71-90 is/are pending in the application.
- 4a) Of the above claim(s) 71-76 and 81-85 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 77-80 and 86-90 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB-06)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's amendment filed on November 09, 2009, which amends the specification, cancels claims 56-70 and adds claims 71-90, has been entered.

Claims 71-90 are pending.

2. New submitted claims 71-76, drawn to a method of forming an electroluminescent device, and claims 81-85, drawn to a method for preparing an electroluminescent compound, are directed to an invention that is independent or distinct from the invention originally claimed.

The originally examined claims were directed to an electroluminescent diiridium compound and an electroluminescent device comprising the compound.

Since applicant has received an action on the merits for the originally presented invention, this invention has been constructively elected by original presentation for prosecution on the merits. Accordingly, claims 71-76 and 81-85 are withdrawn from consideration as being directed to a non-elected invention. See 37 CFR 1.142(b) and MPEP § 821.03.

Withdrawn process claims will be considered for rejoinder if/when a product claim is found to be allowable. See MPEP 821.04 (b) for the conditions necessary for rejoinder of withdrawn process claims. If product claims 77 and 86 were found to be allowable as presently written, the withdrawn process claims would be rejoined. The examiner respectfully suggests

that if amendments are made to the independent product claims, the independent method claims be amended accordingly to maintain the conditions necessary for rejoinder.

3. All rejections set forth in the Office action mailed June 09, 2009 are rendered moot by claim cancellation.

The rejection under 35 U.S.C. 102(e) based on Tsuboyama et al. (US 2003/0152802 A1) does not apply to the new claims because Tsuboyama '802 does not disclose any iridium compounds having a ketone linking ligand meeting the limitations of R₁ to R₄ as defined in the present independent claims. However, Tsuboyama '802 has been reapplied under 35 U.S.C. 103(a) in combination with other prior art references that disclose ketone ligands having alternative R groups.

4. The disclosure is objected to because of the following informalities:

The chemical equations on pages 19 and 20 have been amended by applicant's amendment filed November 19, 2009. While some of the changes to the equations are appropriate, others introduce errors.

In the equation on page 19, the changes to the formula to the right of the arrow are appropriate. However, the changes to the equation on the left side of the arrow are not correct. As written, the equation is unbalanced; four phenylpyridines are required to balance the equation. Either "+ 2" should be changed to "+ 4", or the equation to the left of the arrow should be returned to the original text.

In the equation on page 20, the first reactant shown in the equation as amended is incorrect. Applicant is correct that the first reactant as shown in the original text for this equation was incorrect, but the correct formula is $[(ppy)_2Ir]_2Cl_2$. The first formula as shown in the amended equation only provides two ppy, whereas four ppy are required to balance the equation.

Page 20, line 26, and page 21, lines 1-2, include the abbreviation $Ir_2(diacac)_2(dpp)_2$. Page 21 indicates that this is the diiridium complex synthesized in example 3. The complex synthesized in example 3 has two Ir, one diacac (the bridging ligand as a whole), and four ppy. Accordingly, it appears that abbreviation should be $Ir_2(diacac)(ppy)_4$.

Appropriate correction/clarification is required.

5. Claims 77-80 and 86-90 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The scope of the variables R_1 to R_4 is unclear because is not clear if/how some of the groups recited in dependent claims 78 and 87 are within the scope of the possibilities recited in independent claims 77 and 86. It is also not clear if substituted aromatic, heterocyclic and polycyclic ring structures may be connected to the carbon to which a particular R variable is attached via a substituent instead of via the ring structure.

The scope of aromatic and heterocyclic alkoxy groups, aromatic and heterocyclic aryloxy groups, and aromatic and heterocyclic carboxy groups as recited in claims 78 and 87 is not

clear. Although this terminology is used in the specification, no specific examples of such groups are provided that might clarify the scope. For example, it is not clear if this claim language refers to alkoxy groups, aryloxy group and carboxy groups that are substituted with an aromatic or heterocyclic ring, with an oxygen of the "oxy" group being bonded to the carbon to which the R variable is attached per the formula.

It is also not clear if/how aromatic and heterocyclic alkoxy groups, aromatic and heterocyclic aryloxy groups, and aromatic and heterocyclic carboxy groups are within the scope of the groups recited in claims 77 and 86. It is not uncertain if these groups are intended to be within the scope of substituted aromatic, heterocyclic and polycyclic ring structures as recited in the independent claims.

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claims 77, 78 and 86-90 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsuboyama et al. (US 2003/0152802 A1) in view of Lamansky et al. (US 2002/0182441 A1), Tsuboyama et al. (US 2003/0068536 A1), and Yamazaki (*Trends in Inorganic Chemistry*, Vol. 1, 1990, pp. 75-84).

See the entire Tsuboyama '802 patent application publication. In particular, see Fig. 1A-1D, paragraphs [0001]-[0005], [0008]-[0009], [0015], [0027]-[0035], [0037] and [0065] (especially formulac 15, 20-26, 31 and 32 on pages 7-8), and compound Nos. 211-217, 222, 223 and 269 as defined in Tables 5 and 6 (pp. 10-11). Tsuboyama's metal coordination compounds are disclosed for use in the luminescence layer of an organic luminescence device comprising a luminescence layer positioned between an anode and a cathode.

Each of Tsuboyama's metal coordination compound Nos. 211-217, 222, 223 and 269 is an electroluminescent iridium compound similar to compounds having the general chemical formula set forth in present claims 77 and 86. These prior art compounds do not meet the definition of R₁ to R₄ as defined in the present claims because each of these compounds has a methyl group at the positions corresponding to present R₁ to R₄.

Tsuboyama's compound No. 211 is essentially two molecules of Ir(ppy)₂acac linked together by a single bond connecting the acac (acetylacetonate) ligand of each of the two molecules, and compounds such as Nos. 212-217 are substituted derivatives thereof wherein the phenylpyridine ligands have a substituent on each phenylpyridine ligand. While Tsuboyama '802 does not disclose complexes in which two diketone ligands other than acac form the quadridentate ligand, other diketone ligands that could be used in place of acac were known in the art at the time of the invention as evidenced by Lamansky et al. and Tsuboyama et al. ('536), and methods to link two diketone ligands together at the position required to form the quadridentate ligand of the present compounds were known as evidenced by Yamazaki.

For example, Lamansky et al. teach that diketone ligands having t-butyl groups or phenyl groups may be used for the same purpose as acac (a diketone ligand having methyl groups); see the first, fourth and sixth formulac in Lamansky's Figure 6c. These ligands are all taught as suitable for making electroluminescent compounds, which may be iridium compounds.

In Tsuboyama '536, see formula (4) in claim 1. When each of E and G is a methyl group (an alkyl group having 1 carbon atom), the ligand of formula (4) is acac. E and G may be linear or branched alkyl groups having 1 to 20 carbon atoms in which a hydrogen can optionally be replaced by a fluorine atom, and aromatic groups capable of having a substituent as set forth in claim 1 of Tsuboyama '536. Groups such as t-butyl groups, substituted aliphatic groups, substituted and unsubstituted aromatic groups and fluorocarbon groups are within the scope of E and G for the formula (4) structure as defined in Tsuboyama '536. The formula (4) structure is part of an electroluminescent compound, which may be an iridium compound.

One of ordinary skill in the art at the time of the invention, having knowledge of the teachings of Tsuboyama '802, would have been motivated to make similar compounds with the expectation that compounds that are similar in structure would be electroluminescent and could be used in a device as taught in the '802 reference. One of ordinary skill in the art at the time of the invention, having knowledge of the teachings of Lamansky et al. and Tsuboyama '536, would have reasonably expected that quadridentate ligands provided by two linked diketone ligands selected from diketone ligands known in the art to be suitable for electroluminescent compounds, could be used in place of the quadridentate ligand of formula 15 used in Tsuboyama '536.

With respect to the recitation in present claim 77 that the electroluminescent layer comprising the iridium compound is deposited by vacuum evaporation, product-by-process claims are not limited to the process steps recited, only to the structure implied by the steps. Given the teachings of the prior art references as a whole, it is the examiner's position that it would be obvious to one of ordinary skill in the art at the time of the invention to make compounds similar to compound Nos. 211-217, 222, 223 and 269 of Tsuboyama '802 having other ketone linking ligands, such as those derived by linking two diketone ligands having the alternative structures disclosed by Lamansky et al. or Tsuboyama '536, and to use such compounds to form an electroluminescent layer between a pair of electrodes.

Further, with respect to claim 77's recitation of vacuum evaporation, and the recitation in claim 86 of a compound "capable of being vacuum-evaporated onto a substrate for use as an electroluminescent layer", it is the examiner's position that it is reasonable to expect that Tsuboyama's compound Nos. 211-217, 222, 223 and 269 inherently are capable of being vacuum evaporated and that similar compounds having other ketone linking ligands would also inherently have this capability. Tsuboyama's compounds are taught for use in an electroluminescent layer, and vacuum deposition is utilized in some of Tsuboyama's device examples. Although Tsuboyama does not provide a device example in which one of compound Nos. 211-217, 222, 223 and 269 is vacuum deposited, it is reasonable to expect that any of these compounds is capable of being vacuum deposited. Further, Tsuboyama's compound No. 211 is applicant's compound of Example 3, which is capable of being vacuum-evaporated onto a substrate for use as an electroluminescent layer.

With respect to claim 89, one of ordinary skill in the art at the time of the invention would reasonably expect that compounds similar to at least Tsuboyama's compound Nos. 211-216 and 269, but having different ketone linking ligands, would inherently be capable of exhibiting green electroluminescence because the substituted and unsubstituted phenylpyridine ligands of these compounds would be expected to be the ligands most affecting the color of light emission, and green emission would be expected from these substituted and unsubstituted phenylpyridine ligands.

8. Claims 79 and 80 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsuboyama et al. (US 2003/0152802 A1) in view of Lamansky et al. (US 2002/0182441 A1), Tsuboyama et al. (US 2003/0068536 A1), and Yamazaki (*Trends in Inorganic Chemistry*, Vol. 1, 1990, pp. 75-84) as applied to claims 77, 78 and 86-90 above, and further in view of Kathirgamanathan (WO 98/58037).

Tsuboyama '802 does not disclose mixing an iridium compound with an electroluminescent europium complex in a single electroluminescent layer, or using two electroluminescent layers, one containing an iridium compound and the other containing an europium complex. Electroluminescent europium complexes within the scope of those required for present claims 79 and 80 were known in the art at the time of the invention. Kathirgamanathan discloses such europium complexes. For example, see Examples 6-10 on pages 9-13 of WO '037. The europium complex required by present claim 80 is the complex of Example 6 in WO '037. Further, it was known in the art at the time of the invention that more

than one light-emitting material could be used in combination so as to alter the color of light emitted by the device. For example, Kathirgamanathan teaches on page 6 that mixtures of electroluminescent metal complexes can be used to modify the color of emitted light. Absent a showing of unexpected results commensurate in scope with present claims 79 and 80, it is the examiner's position that it would have been a *prima facie* obvious modification to one of ordinary skill in the art at the time of the invention to use combinations of electroluminescent materials, such as iridium compounds similar to those of Tsuboyama '802 (including those having different ketone linking ligands) and the europium complexes taught by Kathirgamanathan, in the luminescence layer of an EL device.

9. Any inquiry concerning this communication should be directed to Marie R. Yamnitzky at telephone number (571) 272-1531. The examiner works a flexible schedule but can generally be reached at this number from 7:00 a.m. to 3:30 p.m. Monday and Wednesday-Friday.

The current fax number for all official faxes is (571) 273-8300. (Unofficial faxes to be sent directly to examiner Yamnitzky can be sent to (571) 273-1531.)

/Marie R. Yamnitzky/
Primary Examiner, Art Unit 1794

MRY
February 01, 2010